REMARKS

At the outset, the Examiner is thanked for the review and consideration of the present application. The following are submitted as a full and complete response to the Office Action.

Amendments to the Specification

Examiner pointed out that the term "black diamond" as a trademark should be capitalized. Applicant respectfully amends the term throughout the specification as aforementioned.

Amendments to the Claims

Claims 1, 9, 11 and 14 are amended to clarify the characteristics of the present invention in order to overcome the Rejection under 35 USC §112. The basis of the amendments can be found throughout the specification, for example, as shown in paragraphs [0010] and [0021]. No new matter is introduced into the above amendments, which are all fully supported by the original specification in the present invention.

Claim Rejections - 35 USC § 112

Claims 9 and 14 are rejected under 35 USC 112. Examiner indicated that Claims 9 and 14 include recitation of a trademark and since such use in the claim is a limitation to identify or describe a particular material or product, the claims do not comply with 35 USC 112 2nd paragraph.

For clarifying the characteristics of the present invention on this issue, a quotation of MPEP 2173.05(u) Trademarks or Trade Names in a Claim - 2100 Patentability is listed as following:

"The presence of a trademark or trade name in a claim is not, per se, improper under 35 U.S.C. 112, second paragraph, but the claim should be carefully analyzed to determine how the mark or name is used in the claim. It is important to recognize that a trademark or trade name is used to identify a source of goods, and not the goods themselves."

In view of the quotation, Claims 9 and 14 are amended to clearly indicate that "BLACK DIAMOND" is used to identify the sources of the organosilicate glass layer and the low-k dielectric layer. Accordingly, it is believed that the amended Claims 9 and 14 have complied with the requirement and therefore withdrawing the rejection of 35 U.S.C. 112 is respectfully requested.

Double patenting

Examiner indicated that should Claim 2 be found allowable, Claim 11 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. Now Claim 2 is deleted and therefore withdrawing the rejection of double patenting is respectfully requested.

Claim Rejections - 35 USC § 112

Claims 1, 2, 7-10, 11, 14 and 15 are rejected under 35 USC 112. Examiner indicated that the specification, while being enabling for supplying NF_3 gas as the reactant gas, does not reasonably provide enablement for any number of infinite number of reactant gases in situ.

With respect to this rejection, Applicant further limits Claims 1 and 11 by adding the limitation of "the reactant gas containing fluorine to etch back said low-k dielectric layer and react with said process gas." It should be noted that the recited reactant gas is not of any number of infinite number. In the amended Claims 1 and 11, the reactant gas is clearly limited by containing fluorine as well as having the abilities of etching back the low-k dielectric layer and reacting with said process gas. Although only NF_3/C_xF_x gas as the reactant gas are provided, it is just for illustration rather than limitation. Persons skilled in the art, while reading the specification of the present invention, would have understood that the present invention is enabled not only by NF_3/C_xF_x gas but also by other fluorine-containing gas having the abilities of etching back the low-k dielectric layer as well as reacting with said process gas. Accordingly, Applicant respectfully requests that the rejection of 35 U.S.C. 112 should be withdrawn.

Claim Rejections –35 USC § 103

Claims 1, 2, 3, 7, 8, 9, 11 and 14 are rejected under 35 USC 103(a) as being unpatentable over MacNeil et al. (US Patent Publication 2001/0030369 A1) in view of Zhang et al. (US Patent 6468927 B1). Applicant respectfully traverses the rejection for the reasons set forth below.

With respect to Claim 1, Applicant notes that neither MacNeil et al. nor Zhang et al. disclose the limitation of "introducing a reactant gas containing fluorine to etch back said low-k dielectric layer." As for the limitation, Examiner states the process of MacNeil in view of Zhang discloses supplying NF_3 into the process chamber in situ and therefore the prior art discloses all the process steps as claimed by the applicant and therefore the process of MacNeil in view of Zhang must necessarily result in etching back the low-k dielectric layer.

Applicant disagrees with the Examiner on the statements because Zhang et al has clearly revealed their unawareness of etching back the low-k dielectric layer. Zhang et al teach, "Nitrogen is added in its preferred form of N_2, it may be added in other forms in alternative embodiments. Suitable compounds for introducing nitrogen dopants include N_2O, NH_3 and NF_3" (referring to Column 14, lines 18-23). Zhang et al also teach, "the preferred fluorine-containing gas is SiF_4" (referring to Column 3, line 19-21). Thus, what Zhang et al teach is to introduce Fluorine by way of SiF_4 rather than NF_3. Furthermore, if Zhang et al were aware of introducing NF_3 to etch back the dielectric layer, they would not teach providing SiF_4 additionally in the process because etching the dielectric layer using NF_3 will generate SiF_4. Note that when etching, NF_3 will react with the element Si contained in the dielectric layer to produce SiF_4. Therefore, SiF_4 is unsuitable to be an etchant for the dielectric layer.

In the present invention, Claim 1 recites "introducing a process gas to form a low-k dielectric layer over said substrate; and in situ introducing a reactant gas containing fluorine to etch back said low-k dielectric layer and to react with said process gas to form a dielectric layer containing an extra element on said low-k dielectric layer." As having etched back said low-k dielectric layer by the fluorine-containing reactant gas, there is no needed to provide SiF_4 as taught by Zhang et al. Therefore, Claim 1 of the present invention is certainly unobvious over MacNeil et al. in view of Zhang et al. Claim 1 is accordingly patentable and Claims 3, 4, and 7-10 depending thereupon are likewise applied.

With respect to Claim 11, it is also patentable based on the same reason above. Additionally, Claim 11 further recites the limitation of “a volume ratio of said reactant gas to said process gas is larger than about 2.” As for this limitation, Examiner states that MacNiel discloses supplying a nitrogen gas to form a methyl doped Silicon nitride in the ratio as claimed. Applicant disagrees with the Examiner on the statement because the recited volume ratio of Claim 1 is related to the fluorine-containing reactant gas for etching back the low-k dielectric layer rather than nitrogen gas disclosed by MacNiel. Therefore, Claim 1 of the present invention is certainly unobvious over MacNeil et al. in view of Zhang et al. Claim 11 is accordingly patentable and Claims 12, 14, and 15 depending thereupon are likewise applied.

Claims 4 and 12 stand rejected as being unpatentable over MacNeil et al. in view of Zhang et al. and further in view of purported admitted state of the art as disclosed by the Applicants. Applicants disagree. As noted above, no combination of MacNeil and Zhang teach or suggest “the reactant gas containing fluorine to etch back said low-k dielectric layer and react with said process gas,” as set forth in claims 1 and 11, from which claims 4 and 12 depend. Similarly no combination of MacNeil, Zhang, and O’Neil teach or suggest “the reactant gas containing fluorine to etch back said low-k dielectric layer and react with said process gas.” As set forth in claims 9-10 and 14-15.

CONCLUSION

In view of the above remarks, it is believed that all the claims clearly distinguish over the prior art documents relied on by the Examiner. In view of this, Applicants respectfully request that a timely Notice of Allowance be issued to this application.

Respectfully submitted,

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